Chapter 5
Cognitive Processes Involved in Visual Thought

ABSTRACT

Cognitive thinking is discussed here in terms of processes involved in visual thought and visual problem solving. This chapter recapitulates basic information about human cognition, cognitive structures, and perceptual learning in relation to visual thought. It tells about some ideas in cognitive science, cognitive functions in specific parts of the brain, reviews ideas about thinking visually and verbally, critical versus creative thinking, components of creative performance, mental imagery, visual reasoning, and mental images. Imagery and memory, visual intelligence, visual intelligence tests, and multiple intelligences theory make further parts of the chapter. This is followed by some comments on cognitive development, higher order thinking skills, visual development of a child, the meaning of student art in the course of visual development, and the role of computer graphics in visual development.

INTRODUCTION

In a book of an Italian writer, semiotician, and philosopher Umberto Eco (1990) a human person is having a conversation with a robot named Charles Sanders Personal. This person says to a robot,

To think means to have internal interpretations corresponding to the expressions you receive or produce. You have told me a lot about your memory. Well, your memory is inside you. You process the sentences you receive according to your internal encyclopedias. The format of these encyclopedias is inside you (Eco, 1990, p. 281).

And the robot responds,

I do not know whether my memory is the same as that of my masters. According to my information, they are very uncertain about what they have inside

DOI: 10.4018/978-1-4666-4703-9.ch005

them (as a matter of fact, they are not even sure that they have an Inside). That is the reason why they set me up. They know what I have inside me, and, when I speak in a way they understand, they presume that they have the same software inside them. (Eco, 1990, p. 281)

This chapter links cognitive processes with actions involved in visual thought and visual problem solving. They will be applied in interactive projects offered in this book. The content of this chapter provides basic information about human cognition and cognitive science, which relates to visual reasoning, aesthetic emotions, and art. Translation of scientific concepts to the realm of visual interpretations necessitates activation of processes involving cognitive structures, and perceptual thought. Themes discussed here will return in the following chapters tying reasoning about science and computing with mental stimulation to perceptual thinking. Scientists are developing cognitive computing theories and working on constructing cognitive computers that perceive, conclude, and learn. For this reason they need to study the cognitive potential of the brain. Gaining knowledge about the cognitive ability of the human brain and intelligence fosters investigations on information-processing mechanisms in computing and supports cognitive informatics.

BASIC INFORMATION ABOUT HUMAN COGNITION AND COGNITIVE SCIENCE

It is a common knowledge that investigations into visual intelligence, visual thinking, and actions like visual reasoning, problem solving, and decision-making all belong to a domain of cognitive science. Scientists explore how intelligence is implemented in animals and humans, along with applying essential features of intelligence to computing in order to develop artificial intelligence. Cognitive science studies intelligence as the ability to perform intellectual tasks by humans, intelligent organisms, or intelligent programs. It examines how people perceive, represent, and communicate information, both visually and verbally. Cognitive science evolved from the study of intelligence that was first based of a study of animal and human behavior developed mostly by the physiologist Ivan Petrovich Pavlow (1849-1936; awarded the Nobel prize in 1904) and the psychologist Burrhus F. Skinner (1904-1990). The launching of the cognitive movement is credited to the linguist Noam Chomsky (1967). In contrast with the Skinnerian behaviorist principles of associations, Chomsky built his theories on the concept of language and its complex internal representations encoded in the genome, which cannot be broken down into a set of associations. According to Chomsky, language faculty is a part of the organism's genetic endowment in the same way as other physiological systems. Then, the computational neuroscience analyzed complex biological systems such as brain or visual system. David Marr (1982/2010) considered them as an information processing systems. He described the modular organization of the visual processing system at three levels: the computational level that defines what the system is doing considering sensory information as an input, the algorithmic level describing processes that convert that input into the output, and the implementation level explaining how the information processing is physically realized by the system.

Figure 1 shows a work resulting from readings on human cognition that push us to make telling observations about our own mental and emotional processes and make predictions about future. The city scene repeats the pattern of encounters with individuals and groups, and the recurring division of time between the duty and leisure, social and private.